

Understanding Trade, Exchange Rates and International Capital Flows

By Jian Wang



Global trade collapsed following the financial crisis in 2008–09. Imports and exports plunged in major trade countries, and global trade suffered the biggest contraction since World War II.



The U.S. has embraced rapid globalization since the 1970s, with the trade share of gross domestic product (GDP) increasing from less than 6 percent in 1970 to over 15 percent in 2013. Financial integration is even more phenomenal: The GDP share of foreign assets invested in the U.S. increased more than tenfold from around 10 percent in 1970 to over 150 percent in 2013. U.S. financial assets invested abroad grew at a similar pace over the period.

The rapid real and financial globalization in the past 30 years poses many challenges to policymakers in the U.S. and around the globe. When making decisions at home, they can no longer ignore changes abroad. Policymakers must better understand the interaction among domestic and foreign economies as they seek to maximize their nation's welfare.

My research has primarily focused on understanding the interactions of economies through international trade and financial markets. Globalization has made countries more integrated than ever, and countries are no longer insulated from shocks that originate from abroad. Policymaking requires an understanding of how real and monetary changes are transmitted across countries through international trade and financial markets.

International Trade and Exchange Rate Pass-Through

Engel and Wang (2011) found that standard open-economy models significantly understate the importance of trade in economic fluctuations. International trade growth varies substantially more than a nation's total output growth over time, data show. For instance, imports and exports are about three times more volatile than GDP in the U.S. and in most other countries, but they are less volatile than GDP in standard open-economy models used to investigate the spillovers of shocks originating in one country. These standard models substantially

underestimate foreign country influence through international trade on a domestic economy and may provide misleading policy suggestions.

Why is international trade more volatile than GDP in the data? Examining the properties of traded goods across countries helps answer the question. Most international trade for Organization for Economic Cooperation and Development (OECD) countries involves durable goods, which include durable consumption goods (such as automobiles and personal computers) and capital investment (such as machinery). Durable goods purchases fluctuate more over business cycles than nondurable goods. Families can postpone replacing automobiles during a downturn more easily than they can defer nondurable purchases of food and gasoline. Because a large share of GDP is nondurable goods and international trade is mainly in durable goods, international trade volume varies substantially more than GDP in the data. We find that including durable goods trade in an otherwise standard model, which doesn't distinguish between durable and nondurable goods, can broadly improve the model's ability to match trade sector data.

Global trade collapsed following the financial crisis in 2008–09. Imports and exports plunged in major trade countries, and global trade suffered the biggest contraction since World War II. Various policies have been proposed in response to this decline. Based on research with Charles Engel, I discussed the collapse of global trade in a Federal Reserve Bank of Dallas *Economic Letter* (Wang 2010), which argues that the drop in international trade was generally consistent with cyclical trade movements over the past 35 years. Empirical findings and a theoretical model in Engel and Wang (2011) predict a large drop in the volume of trade when markets experience a steep recession, especially if a prolonged downturn is expected. Several subsequent studies confirm that the collapse of global trade in the recent financial crisis was main-

ly attributable to a collapse of worldwide demand for durable goods (*Chart 1*), though other factors, such as trade finance, may have played a role.

The exchange rate is a focal point of international economic activities. Exchange rate fluctuations alter the relative prices of goods and services between countries and, thus, substantially impact international trade.

An important channel through which the exchange rate affects the real economy is aggregate price levels. The extent that exchange rate changes are passed through to prices is referred to as exchange rate pass-through (ERPT). Import price ERPT declined sharply after the 1990s (see Marazzi and Sheets 2007 for an example involving the U.S.). An and Wang (2012) and Mumtaz, Oomen and Wang (2011) document that greater economic stability after the 1980s—especially involving monetary policy and inflation—contributed to reduced ERPT.

The findings suggest that ERPT decline is related to more disciplined monetary policy after the 1980s. Several factors may contribute to this during such a stable monetary regime. Shambaugh (2008) documents that ERPT is greater for nominal shocks (for example, monetary policy shocks) than for real shocks (for example, demand shocks). An economy experiences fewer nominal shocks in a regime with more stable monetary policy and inflation, and thus its ERPT is lower. The research shows that low ERPT is not independent of monetary policy. Therefore, it is misleading to argue that central banks can afford looser policy when inflation is less responsive to exchange rate movements.

Another problem found in previous studies of ERPT is that aggregate price indexes may underestimate the impact of exchange rates on U.S. import prices. In goods-level data underlying U.S. trade price indexes, Nakamura and Steinsson (2012) document that 40 percent of products are replaced without a single price change. They argue that price adjustments for these goods are through product replacement rather than regular price changes: Firms replace existing products with new models and designs at a new price rather than changing current-item prices. Standard price indexes that focus on price changes for identical products cannot capture this type of adjustment and underestimate the extent of price changes in

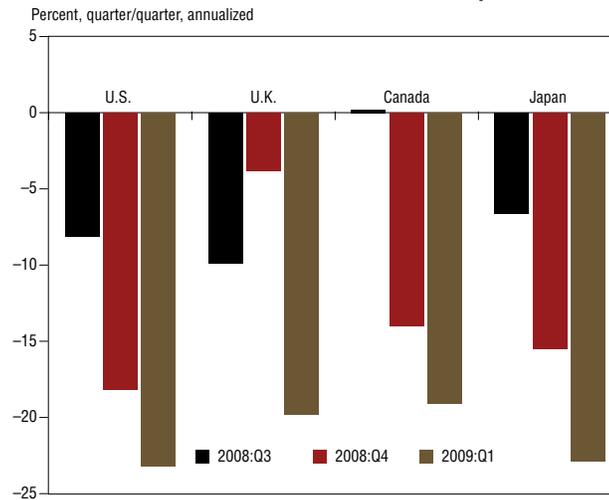
the economy.

Kim et al. (2013) investigate the product-replacement bias involving trade between the U.S. and China and find that renminbi appreciation substantially affects prices of U.S. imports from China after taking into account price changes through product replacement. Following China's abandonment of its hard-currency peg to the U.S. dollar in June 2005, the renminbi appreciated more than 25 percent by September 2014. However, only a very small fraction of the Chinese currency gain was passed on to U.S. import prices when ERPT was estimated from aggregate price indexes. For instance, Auer (2012) finds that ERPT of renminbi appreciation from 2005 to 2008 into the U.S. import price index was only around 20 percent.

Why didn't Chinese exporters pass along production cost increases following renminbi appreciation, at least in the long run? One reason could be producers' voluntary reduction of profit margin, which would help them maintain market share. However, China's exports to the U.S. are mainly from labor-intensive industries, and it is unlikely that Chinese exporters have a large profit margin with which to absorb currency appreciation. A large share of imported inputs is another potential reason for the low ERPT observed in the data (see Amiti, Itskhoki and Konings 2014). China imported many of its inputs from other

Chart 1

Real Demand for Durable Goods Declines Globally



SOURCES: Bureau of Economic Analysis; author's calculations.

countries, and the prices of imported materials decreased when the renminbi appreciated, imposing downward pressure on China's export prices to the U.S. However, this explanation conflicts with the fact that the Chinese currency did not appreciate much against countries providing a major source of inputs—such as Japan and South Korea—while it gained strongly against the U.S. dollar.

Kim et al. (2013) find that Chinese exports did not absorb as much renminbi appreciation as the aggregate import price index suggested. The authors found that for a large fraction of U.S. imported goods from China, prices never changed. Less than 50 percent of renminbi appreciation is passed through to U.S. import prices from China if these “no-price-change” goods are included in the estimation of ERPT. Pass-through increases to about 100 percent if goods with at least one price change are included. In other words, ERPT is much higher if goods that change prices through product replacement are excluded, suggesting that the conventional estimation of ERPT based on aggregate price indexes underestimates the effect of renminbi appreciation on U.S. import prices.

Exchange Rate Determination and Business Cycles

Besides international trade, the exchange rate plays an important role in international

financial markets. The foreign exchange market is the largest and most liquid financial market in the world. Its average daily turnover exceeds \$5 trillion, according to a 2013 survey by the Bank for International Settlements. Currency trading is important for individuals, firms and governments that buy foreign goods and services, invest abroad and seek profit or protection through speculation.

Despite the significance of exchange rates in economic activity, researchers and policymakers still debate the factors driving their fluctuation and whether the central banks should consider exchange rate movements when conducting monetary policy.

Wang (2011) finds that the effect of including exchange rate stabilization in the Taylor rule depends on several key factors (the rule theorizes that an appropriate policy rate is based on an economy's performance relative to its capacity, the output gap and the rate of inflation). Those factors include the source of exchange rate fluctuation, the central bank's stance on inflation and a country's trade openness. If the central bank takes a strong stance on inflation, exchange rate stabilization can improve welfare by fine-tuning interest rates to alleviate international price distortions

caused by noisy exchange rate movements and sticky prices. Admittedly, welfare improvement from exchange rate stabilization is small in the model, especially if a country's consumption is biased toward home-produced goods and services, such as in the U.S.

For countries that do not appropriately anchor inflation, stabilizing the exchange rate through monetary policy will substantially increase macro instability and reduce overall welfare. In this case, when a central bank attempts to alter interest rates in response to exchange rate changes, it will tend to amplify the negative effect of exchange rate noise by destabilizing the inflation rate.

Following the 2008 financial crisis, the Federal Reserve instituted several rounds of quantitative easing (QE) to stabilize the financial markets and aid U.S. economic recovery. QE policy in the U.S. inevitably spilled over to other countries through exchange rates and interest rates. Wang (2011) suggests that the central banks in other countries should continue to focus on inflation stabilization and let exchange rate swings mostly run their course. Unfortunately, policymakers, particularly those in emerging markets, could not restrain themselves from loosening monetary policy to stabilize their currency's value. As my model predicted, countries focusing more on exchange rate stabilization during this period suffered higher inflation and less-stable domestic macroeconomic conditions (*Chart 2*).

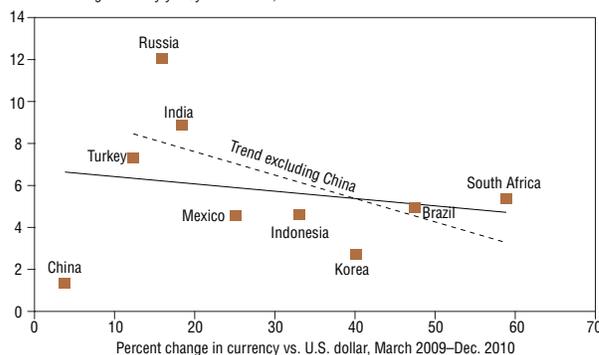
This paper assumes that the exchange rate was mainly driven by noise in financial markets. Although this is a useful way for theoretical models to match exchange rate behavior in the data, it remains highly debatable whether exchange rates are determined by economic fundamentals or by noise unrelated to economic fundamentals. Therefore, understanding the factors driving exchange rate movements remains an important research topic.

In a seminal paper, Meese and Rogoff (1983) find that economic fundamentals—such as money supply, balance of trade and national income—are of little use when forecasting out-of-sample exchange rates. This casts doubt on fundamental-based exchange rate models. Various combinations of economic variables and econometric methods have been used in attempts to over-

Chart 2

Inflation Lower in Countries Not Trying Exchange Rate Stabilization

Percent average monthly year/year inflation, March 2009–Dec. 2010



NOTE: The greater the percent change in currency vs. the U.S. dollar, the less likely the country's central bank attempted to stabilize the exchange rate.

SOURCES: National statistics offices of each country; Haver Analytics; *Wall Street Journal*; author's calculations.

turn Meese and Rogoff's finding. Despite some progress on this front, the ability of economic fundamentals to forecast exchange rates remains fragile in most empirical studies, especially at short horizons.

Wang and Wu (2012) take a different approach to address the issue. Instead of estimating the levels of exchange rates in the future, this study provides an interval in which the exchange rate may reside with a certain probability, given predictors available at the time of the forecast. The authors find that economic fundamentals are useful in narrowing forecast intervals for exchange rates, though they are not useful in predicting the future average level.

Engel and West (2005) argue that current economic fundamentals cannot forecast exchange rates because exchange rates, like other asset prices, are determined by expectations of future economic fundamentals rather than the current reality. Engel, Wang and Wu (2010) reconcile the Engel–West theorem with empirical findings that economic fundamentals better forecast exchange rates at longer horizons.

From these studies, we learn that exchange rates are related to expectations regarding economic fundamentals rather than to financial market noise. However, it remains unclear which fundamentals play an important role in driving exchange rates and whether expectations are followed by actual economic fundamental changes. Answers to these questions provide guidance for exchange rate modeling that can be used to analyze international macroeconomic issues.

Nam and Wang (forthcoming) investigate the role that expectations of future productivity play in driving the U.S. exchange rate. The study was inspired by empirical findings that changes in expectations regarding future productivity, measured by total factor productivity (TFP), account for a large fraction of U.S. business cycles. Beaudry and Portier (2006) document that a shock resembling favorable news about future productivity explains more than half of business-cycle fluctuations of U.S. consumption and labor input. Beaudry, Nam and Wang (2011) extend this finding to models with more macroeconomic variables, using alternative econometric methods to identify the shock. They find that bouts of op-

timism and pessimism drive many U.S. business cycles and that increasing optimism is followed by subsequent TFP increases, suggesting a close link between optimism and economic fundamentals.

Two scenarios are consistent with these empirical findings. First, bouts of optimism reflect advance information that agents have about future TFP. In response to good news about future productivity, households increase current consumption and firms raise investment, though current TFP remains constant. In another scenario, agents' exogenous mood swings may cause an economic boom and subsequent productivity increase. Households and firms become optimistic about the future for some unknown reasons, resulting in immediate increases in consumption and investment. The economic boom today can increase future productivity through different channels such as promoting firms' research and development and/or relaxing the financial constraints of small but more productive firms.

Although these empirical findings show the importance of optimism shocks in driving U.S. business cycles, they cannot separate the above two scenarios as underlying mechanisms. It is important to investigate the empirical relevance of these two competing views because they carry totally different policy implications. If optimism shocks reflect advance news about future productivity, there is no need to have policies designed to stabilize such expectation-driven business cycles because the optimism-driven booms are already the optimal behavior of households and firms. However, if economic booms and busts are driven by exogenous bouts of optimism, the economic outcome may be suboptimal and policymakers may want to fight excessive business-cycle fluctuations if they can correctly identify excessive optimism/pessimism.

Nam and Wang (forthcoming) extend the study on optimism-driven business cycles to multicountry settings and examine how expected changes in productivity affect exchange rate fluctuations and international trade. Previous studies in the literature focus on surprise changes in productivity that drive such fluctuations. These empirical and theoretical studies usually underestimate the importance of productivity changes on exchange rate movements and international spill-

overs of technology changes. For instance, previous empirical studies usually find that productivity changes explain only a small fraction (10 percent or less) of exchange rate fluctuations during business cycles (for example, Juvenal 2011). However, Nam and Wang (forthcoming) document that after taking into account both surprise changes and expected future changes, productivity can explain over a third of U.S. exchange rate fluctuations.

Exchange rates are more volatile than economic fundamentals—such as total output—and standard theoretical models fail to replicate this feature in the data. The empirical findings suggest that the inclusion of expected productivity change may help the standard model better reflect the data by more closely matching asset prices (such as exchange rate behaviors). Matsumoto et al. (2011) show that, under certain conditions, incorporating news about future productivity and monetary policy helps standard theoretical models match stock price volatility.

These empirical studies point out challenges for future theoretical modeling of exchange rates. Nam and Wang (forthcoming) document that the U.S. real exchange rate exhibits substantially different dynamics in response to surprise and expected changes in U.S. TFP. Following an expected TFP increase, the real exchange rate appreciates strongly on impact and continues to appreciate for a few quarters before it begins converging back to its initial level. Under the authors' definition of the real exchange rate, a decrease indicates appreciation of the dollar. The response of the real exchange rate to an expected increase in TFP resembles a horizontal J-curve. By comparison, the real exchange rate exhibits a hump-shaped response to a favorable contemporaneous TFP shock: It stays around its initial level on impact of the shock, quickly increases above zero (depreciates) and remains significantly depreciated for more than 12 quarters before converging back to its initial level.

However, standard international macroeconomic models cannot replicate these documented exchange rate behaviors following surprise and expected productivity changes. The authors discuss challenges and potential solutions that would allow standard models to match these empirical findings. They also show that such a model will

There is no strong evidence that foreign ownership can induce productivity gains for target firms relative to domestic-acquired firms.

better match other dimensions of the data such as the negative correlation between cross-country relative consumption and the real exchange rate. These studies have generated better understanding of exchange rate determination and lay the groundwork for theoretical international macroeconomic models that provide more reliable policy analysis involving open economic issues.

International Capital Flows

Recent research (Wang and Wang 2014) considers international capital flows and their impact on host countries' productivity, income and financial conditions, using firm-level data. Conventional wisdom holds that foreign direct investment (FDI) can increase host countries' productivity, both directly by introducing new technologies and indirectly by technology spillovers from FDI firms to domestic ones. As a result, many emerging markets provide tax and other incentives to attract FDI, which has dramatically increased in these countries over the past three decades.

However, the authors find that FDI can be driven by foreign investors' easy access to financial markets rather than their technological advantages. Although numerous empirical studies document the superior productivity performance of FDI-involved plants and firms relative to their domestic counterparts, the positive correlation cannot be simply interpreted as a causal relationship. Instead, it may just reflect endogenous FDI decisions: Foreign investors choose to acquire or start business with more productive domestic firms. For instance, Fons-Rosen et al. (2013) find that FDI has a very small effect on target firms' productivity in their sample of advanced European economies, after controlling for unobservable factors that influence acquisition decisions.

Even after controlling for endogenous choice of FDI firms, a second issue remains for identifying performance gains from foreign ownership. Previous studies found that foreign acquisition can improve target firm performance. However, numerous empirical studies document that domestic mergers and acquisitions are also followed by substantial change in the performance of target firms. See Maksimovic and Phillips (2001) for a study on productivity and McGuckin and Nguyen (2001) for a study on labor input and wages. In particular,

Fons-Rosen et al. (2013) find that negative changes in foreign ownership are also associated with firm productivity improvement, consistent with greater productivity arising from the ownership change. Even though previous studies documented performance gains following foreign acquisitions, it remains unclear whether foreign ownership per se is crucial for the gains. If a domestic entity acquired the target firms, they might have exhibited a similar performance improvement.

Wang and Wang (2014) compare the post-acquisition performance changes for foreign- and domestic-acquired firms in China, which allows us to isolate the specific impact of foreign ownership relative to domestic acquisitions. Although the study uses Chinese data, the results likely apply to other countries, especially other emerging markets.

Several findings stand out. First, there is no strong evidence that foreign ownership can induce productivity gains for target firms relative to domestic-acquired firms. If we compare foreign-acquired firms with domestic firms that experienced no change in ownership, the result is significant productivity gains for foreign-acquired firms in the acquisition year and in subsequent years. These findings suggest that foreign acquisitions in China during the sample period did not differ from domestic acquisitions with regard to productivity, even though both induced productivity gains over companies whose ownership did not change.

Second, foreign ownership significantly improved the financial condition (as measured by leverage and liquidity ratios) of target firms relative to domestic acquisitions. These results show that following transactions, foreign-acquired firms rely less on external short-term debt and more on internal capital than domestic-acquired firms.

Although several empirical studies cast doubt on the productivity benefits of FDI to advanced economies, it may still be reasonable to believe the existence of such gains for FDI to emerging markets because these countries lag far behind in technology. However, the results suggest that even FDI to emerging markets could be mainly driven by financial advantages rather than productivity advantages, casting doubt on the efficacy of tax and financial-benefit policies intended to catch up to the technological frontier. The data also indicate that FDI improves target

firms' exports, supporting the financial channel of FDI in promoting international trade. Manova, Wei and Zhang (forthcoming) find that FDI firms' exports from China outperform domestic firms, a finding that is more pronounced in financially vulnerable sectors. Their results suggest that FDI can mitigate financial constraints of firms in the host countries, promoting exports and economic growth. However, they do not examine the effect of FDI on firm productivity. The results of Wang and Wang (2014) complement Manova, Wei and Zhang's (forthcoming) findings by showing that such a channel remains at work even after excluding the impact of domestic acquisition.

Foreign ownership is also found to increase output, employment and wages of target firms relative to domestic-acquired firms. This may result from improved financial conditions leading to increased sales and market share. The empirical results suggest foreign ownership benefits the host countries by strongly easing target firm financial constraints, promoting their participation in export activities, resulting in increases in output, employment and labor incomes. However, Wang and Wang (2014) do not find strong evidence that foreign ownership increases firm productivity.

Many developing countries provide tax and other incentives to attract FDI. The study shows that FDI acquisitions promote host-country international trade by improving the finances of target firms. Therefore, removing trade barriers through free-trade agreements and World Trade Organization membership is a more effective strategy to attract FDI. The results also suggest that FDI to emerging markets such as China may reflect the inefficiency of their financial markets. Government officials should not be overly concerned with increasing FDI. Instead, emerging-market leaders should reform financial markets rather than provide tax or policy incentives to maintain FDI.

References

Amiti, Mary, Oleg Itskhoki and Jozef Konings (2014), "Importers, Exporters, and Exchange Rate Disconnect," *American Economic Review* 104 (7): 1,942–78.

An, Lian, and Jian Wang (2012), "Exchange Rate Pass-Through: Evidence Based on Vector Autoregression with Sign Restrictions," *Open Economies Review* 23 (2): 359–80.

Auer, Raphael (2012), "Exchange Rate Pass-Through, Domestic Competition, and Inflation: Evidence from the 2005/08 Revaluation of the Renminbi," CESifo Working Paper no. 3759 (Munich: CESifo Group, March).

Beaudry, Paul, and Franck Portier (2006), "Stock Prices, News, and Economic Fluctuations," *American Economic Review*, 96 (4): 1,293–307.

Beaudry, Paul, Deokwoo Nam and Jian Wang (2011), "Do Mood Swings Drive Business Cycles and Is It Rational?" Globalization and Monetary Policy Institute Working Paper no. 98 (Federal Reserve Bank of Dallas, December).

Engel, Charles, and Jian Wang (2011), "International Trade in Durable Goods: Understanding Volatility, Comovement, and Elasticities," *Journal of International Economics* 83 (1): 37–52.

Engel, Charles, and Kenneth D. West (2005), "Exchange Rates and Fundamentals," *Journal of Political Economy* 113 (3): 485–517.

Engel, Charles, Jian Wang and Jason Wu (2010), "Long-Horizon Forecasts of Asset Prices When the Discount Factor Is Close to Unity," Globalization and Monetary Policy Institute Working Paper no. 36 (Federal Reserve Bank of Dallas, September).

Fons-Rosen, Christian, Sebnem Kalemli-Ozcan, Bent E. Sørensen, Carolina Villegas-Sanchez and Vadym Volosovych (2013), "Quantifying Productivity Gains from Foreign Investment," NBER Working Paper no. 18920 (Cambridge, Mass: National Bureau of Economic Research, March).

Juvenal, Luciana (2011), "Sources of Exchange Rate Fluctuations: Are They Real or Nominal?" *Journal of International Money and Finance* 30 (5): 849–76.

Kim, Mina, Deokwoo Nam, Jian Wang and Jason Wu (2013), "International Trade Price Stickiness and Exchange Rate Pass-Through in Micro Data: A Case Study on U.S.–China Trade," Globalization and Monetary Policy Institute Working Paper no. 135 (Federal Reserve Bank of Dallas, August).

Maksimovic, Vojislav, and Gordon Phillips (2001), "The Market for Corporate Assets: Who Engages in Mergers and Asset Sales and Are There Efficiency Gains?" *Journal of Finance* 56 (6): 2,019–65.

Manova, Kalina, Shang-Jin Wei and Zhiwei Zhang (forthcoming), "Firm Exports and Multinational Activity under Credit Constraints," *Review of Economics and Statistics*.

Marazzi, Mario, and Nathan Sheets (2007), "Declining Exchange Rate Pass-Through to U.S. Import Prices: The Potential Role of Global Factors," *Journal of International Money and Finance* 26 (6): 924–47.

Matsumoto, Akito, Pietro Cova, Massimiliano Pisani and Alessandro Rebucci (2011), "News Shocks and Asset Price Volatility in General Equilibrium," *Journal of Economic Dynamics and Control* 35 (12): 2,132–49.

McGuckin, Robert H., and Sang V. Nguyen (2001), "The Impact of Ownership Changes: A View from Labor Markets," *International Journal of Industrial Organization* 19 (5): 739–62.

Meese, Richard A., and Kenneth Rogoff (1983), "Empirical Exchange Rate Models of the Seventies: Do They Fit Out of Sample?" *Journal of International Economics* 14 (1–2): 3–24.

Mumtaz, Haroon, Ozlem Oomen and Jian Wang (2011), "Exchange Rate Pass-Through into U.K. Import Prices: Evidence from Disaggregated Data," Federal Reserve Bank of Dallas *Staff Papers*, no. 14.

Nakamura, Emi, and Jón Steinsson (2012), "Lost in Transit: Product Replacement Bias and Pricing to Market," *American Economic Review* 102 (7): 3,277–316.

Nam, Deokwoo, and Jian Wang (forthcoming), "The Effects of Surprise and Anticipated Technology Changes on International Relative Prices and Trade," www.dallasfed.org/assets/documents/institute/events/2013/527Wangpaper.pdf. Revision of "The Effects of News About Future Productivity on International Relative Prices: An Empirical Investigation," Globalization and Monetary Policy Institute Working Paper no. 64 (Federal Reserve Bank of Dallas, October 2010).

Shambaugh, Jay (2008), "A New Look at Pass-Through," *Journal of International Money and Finance* 27 (4): 560–91.

Wang, Jian (2010a), "Durable Goods and the Collapse of Global Trade," Federal Reserve Bank of Dallas *Economic Letter* 5 (2).

_____ (2010b), "Home Bias, Exchange Rate Disconnect, and Optimal Exchange Rate Policy," *Journal of International Money and Finance* 29 (1): 55–78.

Wang, Jian, and Xiao Wang (2014), "Benefits of Foreign Ownership: Evidence from Foreign Direct Investment in China," Globalization and Monetary Policy Institute Working Paper no. 191 (Federal Reserve Bank of Dallas, September).

Wang, Jian, and Jason Wu (2012), "The Taylor Rule and Forecast Intervals for Exchange Rates," *Journal of Money, Credit and Banking* 44 (1): 103–44.